



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Docket No: Q61365

Jean-Francois GRIMALDI, et al.

Appln. No.: 09/673,614

Group Art Unit: 2833

Confirmation No.: 2115

Examiner: P. NGUYEN

Filed: October 19, 2000

For: A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT

INVENTORS' DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents  
Washington, D.C. 20231

Sir:

We, Jean-Francois Grimaldi and Jean-Marc Dauba, hereby declare and state as follows:

1. We are the coinventors and applicants of the invention entitled "A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT", disclosed and claimed in U.S. Application No. 09/673,614, filed October 19, 2000.
2. At the time we invented the present invention, we were all employed by COMPAGNIE FINANCIERE ALCATEL (hereinafter "ALCATEL"), and were employed in the corporate research center at ALCATEL.
3. Prior to February 16, 1999, the U.S. Filing Date of U.S. Patent No. 6,077,130 TO Hughes et al., the Spring Contact for an Electrical Connector and a Connector Including It invention as described and claimed in the above referenced application was completed in France, as evidenced by the following:

4. Prior to February 16, 1999, having earlier conceived the idea of the Spring Contact for an Electrical Connector and a Connector Including It, as set forth in the specification of the above referenced application, the present invention was formally submitted to our employer ALCATEL.

5. Prior to February 16, 1999, it was standard practice of employees of ALCATEL to submit their inventions to the Intellectual Property Department at ALCATEL on a Fiche d'information technique (hereinafter "FIT"), after their inventions were approved by their supervisors.

6. The submission of the above FIT to the Intellectual Property Department at ALCATEL for the present invention occurred on October 26, 1998, prior to February 16, 1999. The FIT along with its Figures, which comprises a technical part originally written in English, is attached as Exhibit "A".

7. The attached FIT, including its attached Figures, completely discloses the present invention as set forth and claimed in the above referenced application.

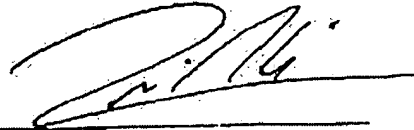
8. On January 25, 1999, in the ordinary course of business, the ALCATEL Intellectual Property Department sent a letter to Mr. Christian Schmit of Cabinet Christian SCHMIT et Associés, a French patent firm, requesting Mr. Schmit to prepare a French Patent Application based on the above FIT. A copy of the letter and an attachment entitled "Technical Information" are attached as Exhibit B, and an English translation of the letter is attached as Exhibit C.

9. Employees of Cabinet Christian SCHMIT et Associés, drafted a patent application titled: A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT in regular order from January 1999 through the application's filing date of March 11, 1999, in the French Patent Office. An English translation of the French patent application FR 9902996 is attached hereto as Exhibit "D."

10. The attached English translation of the French patent application FR 9902996 completely discloses the present invention as set forth and claimed in the above referenced application.

We declare further that all statements made herein are of our own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 03/03/04

By:   
Jean-Francois Grimaldi

Date: \_\_\_\_\_

By: \_\_\_\_\_  
Jean-Marc Dauba



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Docket No: Q61365

Jean-Francois GRIMALDI, et al.

Appln. No.: 09/673,614

Group Art Unit: 2833

Confirmation No.: 2115

Examiner: P. NGUYEN

Filed: October 19, 2000

For: A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT

INVENTORS' DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents  
Washington, D.C. 20231

Sir:

We, Jean-Francois Grimaldi and Jean-Marc Dauba, hereby declare and state as follows:

1. We are the coinventors and applicants of the invention entitled "A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT", disclosed and claimed in U.S. Application No. 09/673,614, filed October 19, 2000.
2. At the time we invented the present invention, we were all employed by COMPAGNIE FINANCIERE ALCATEL (hereinafter "ALCATEL"), and were employed in the corporate research center at ALCATEL.
3. Prior to February 16, 1999, the U.S. Filing Date of U.S. Patent No. 6,077,130 TO Hughes et al., the Spring Contact for an Electrical Connector and a Connector Including It invention as described and claimed in the above referenced application was completed in France, as evidenced by the following:

4. Prior to February 16, 1999, having earlier conceived the idea of the Spring Contact for an Electrical Connector and a Connector Including It, as set forth in the specification of the above referenced application, the present invention was formally submitted to our employer ALCATEL.

5. Prior to February 16, 1999, it was standard practice of employees of ALCATEL to submit their inventions to the Intellectual Property Department at ALCATEL on a Fiche d'information technique (hereinafter "FIT"), after their inventions were approved by their supervisors.

6. The submission of the above FIT to the Intellectual Property Department at ALCATEL for the present invention occurred on October 26, 1998, prior to February 16, 1999. The FIT along with its Figures, which comprises a technical part originally written in English, is attached as Exhibit "A".

7. The attached FIT, including its attached Figures, completely discloses the present invention as set forth and claimed in the above referenced application.

8. On January 25, 1999, in the ordinary course of business, the ALCATEL Intellectual Property Department sent a letter to Mr. Christian Schmit of Cabinet Christian SCHMIT et Associés, a French patent firm, requesting Mr. Schmit to prepare a French Patent Application based on the above FIT. A copy of the letter and an attachment entitled "Technical Information" are attached as Exhibit B, and an English translation of the letter is attached as Exhibit C.

9. Employees of Cabinet Christian SCHMIT et Associés, drafted a patent application titled: A SPRING CONTACT FOR AN ELECTRICAL CONNECTOR AND A CONNECTOR INCLUDING IT in regular order from January 1999 through the application's filing date of March 11, 1999, in the French Patent Office. An English translation of the French patent application FR 9902996 is attached hereto as Exhibit "D."

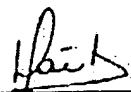
10. The attached English translation of the French patent application FR 9902996 completely discloses the present invention as set forth and claimed in the above referenced application.

We declare further that all statements made herein are of our own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: \_\_\_\_\_

By: \_\_\_\_\_  
Jean-Francois Grimaldi

Date: 06.03.04

By:  \_\_\_\_\_  
Jean-Marc Dauba

Project PMC2	Funding Sources	Research Case	Domain	Product	Keywords
-----------------	-----------------	---------------	--------	---------	----------

**CETTE FIT SERA COMMUNIQUEE A IPD POUR ANALYSE DE BREVETABILITE****Son traitement sera plus rapide si elle est rédigée en langue anglaise.**

IL N'Y A PAS DIVULGATION LORSQUE LA COMMUNICATION S'EFFECTUE DANS LE CADRE D'UN ACCORD DE CONFIDENTIALITE; IL N'EST PAS POSSIBLE DE PROCEDER A UN DEPOT DE BREVET APRES DIVULGATION.

LA PROCEDURE D'URGENCE SERA EVENTUELLEMENT A DECLENCHER SI LA DECISION A ETE PRISE D'UNE DIVULGATION TELLE QUE CONTRIBUTION ETSI, ET PROPOSITION A UN CLIENT SANS NON DISCLOSURE AGREEMENT.

Joindre Justificatif avec la FIT et remettre le dossier en main propre au Responsable Brevets

**Date Emission**

26/10/98

☒

Mobile

☐

Résidentiel

☐**Business Unit**

Professional

☐

Internet

☐

Computer

NOM	PRENOM	SERVICE	SITE	TELEPHONE
GRIMALDI	JEAN-FRANCOIS	MED		0155663422
DAUBA	JEAN-MARC	MED		0155667836

TITRE (Obligatoire - de 10 à 15 mots) - Title (mandatory)

CMS BATTERY CONNECTOR WITH MINIMUM SIZE

**1 - PROBLEME TECHNIQUE A RESOUDRE :**

What is the technical problem which the author of this FIT had to solve ?

To enhance the electrical connection between a PCB and a battery with a thickness and surface as small as possible.

**2 - SOLUTION(S) TECHNIQUE(S) ANTERIEURE(S) :**

Which is to the knowledge of the author the best already existing (prior art) solution to this problem ?

Several connectors already existing but with an other contact shape (other contact bending and cut out design)

**3 - POURQUOI EST-CE INSUFFISANT ? - Why is the best prior art solution not good enough ?**

Connectors already available on the market are too big

## 4 - IDEE DE DEPART AYANT CONDUIT A CETTE SOLUTION - Basic idea of the author's solution

- look for a very thin connector (result=1.8mm)
- give the priority to the thickness in the connector technical design
- use all the connector width to make the contacts as long as possible

## 5 - BREVE DESCRIPTION : JOINDRE DESSINS EVENTUELLEMENT

Short description of the solution (add extra sheet and drawing(s) where necessary)

- see drawings attached
- new contact shape : U shape (usual shape = straight)
- assembling of the contacts is done head to foot in order to
  - \* have a symetric configuration for the connector (strengths and weldings)
  - \* leave a free space for the pick and place area
- contacts are assembled into the plastic and not welded ( less expensive process)

## 6 - AVANTAGE(S) PAR RAPPORT A LA MEILLEURE SOLUTION CONNUE

Advantage(s) of the new solution (wherever possible with quantification) as compared with the best prior art solution(s) referred to under §2 above

- minimum size (thickness = 1.8mm)
- big stroke available (up to 1.5mm)
- important strength available (150g per contact)
- CMS component : automatic soldering process
- this design can not be duplicated : this idea is based on the only possible (and new ) shape for the contacts

## 7 - DESAVANTAGE PAR RAPPORT A CETTE SOLUTION CONNUE :

Disadvantages of new solution (if possible quantify)

- require 2 different shapes of contact

## 8 - EXPERIMENTATION DE LA SOLUTION

Has the new solution been proved to be workable by experiment, by simulation, by use (if all answers are negative, when can such prove be expected)?

OUI ☒ NON ☐ QUAND 

Merci de répondre à la question posée.

## 9 - DATE DE 1ERE PUBLICATION OU DATE D'UTILISATION PUBLIQUE DU PRODUIT AVEC LA SOLUTION

Date of envisaged first publication or sale or public use of a product using the new solution

## 10 - EST-IL ENVISAGE DE PRESENTER LA SOLUTION TECHNIQUE A LA STANDARDISATION ?

Is it expected that this technical solution will be presented as proposal to a standardization body? if so : when? to which body?

NON ☐ OUI ☐ QUAND  OU 

Merci de répondre à la question posée.

## 11 - Y-A-T-IL UNE RAISON POUR QUE LA SOLUTION TECHNIQUE PUISSE AVOIR UN INTERET PARTICULIER POUR NOS CONCURRENTS : QUI ? QUELLE RAISON ?

Is there any reason to believe that this technical solution is of particular interest to competitors? if so: which competitor(s) and for what particular reason?

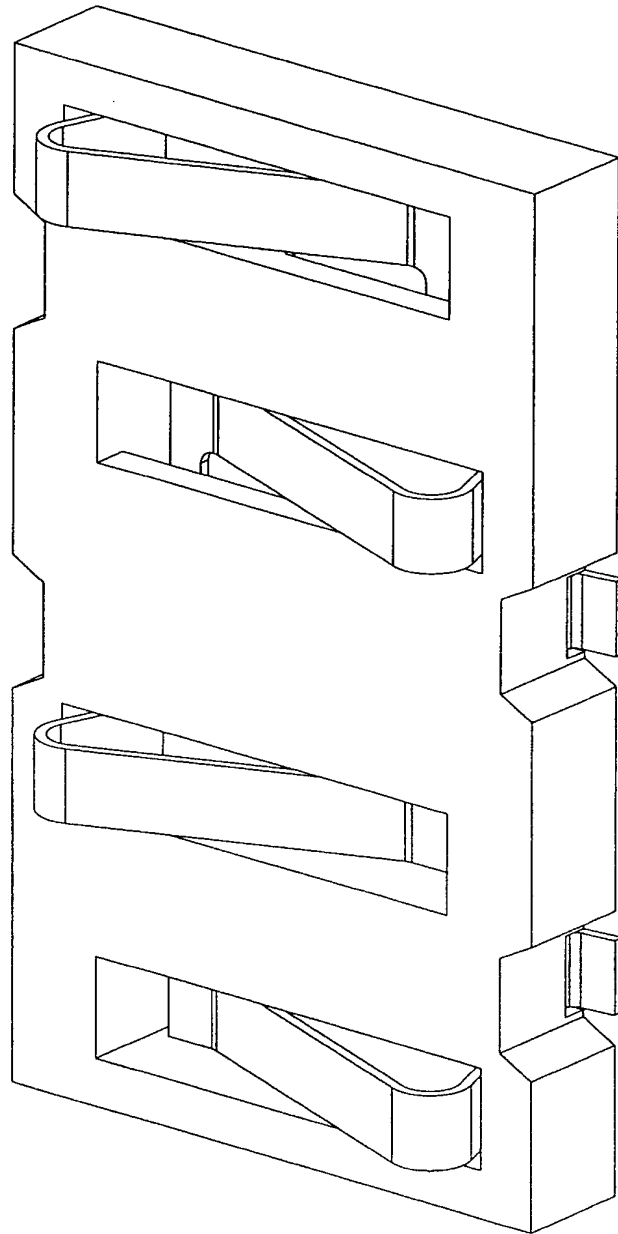
YES. For any firms involved in the mobile phones design.

Reason = this connector participate to the phones size reduction. This concept could be used by one of our competitors.

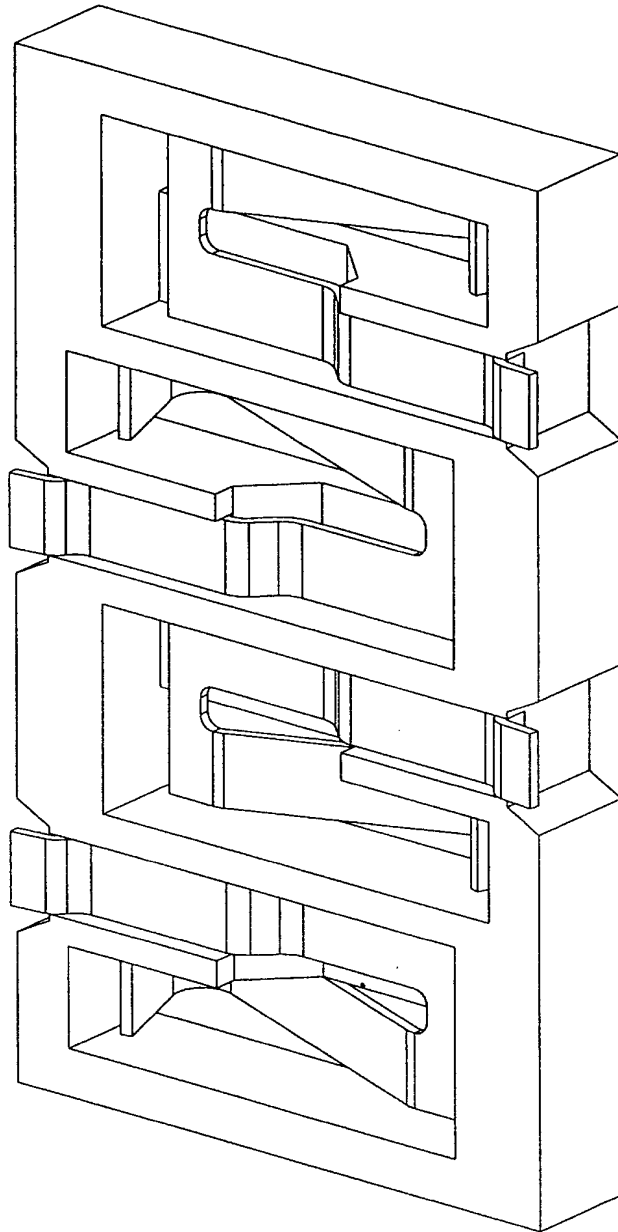
## 12 - AUTRE INFORMATION UTILE - Other useful information



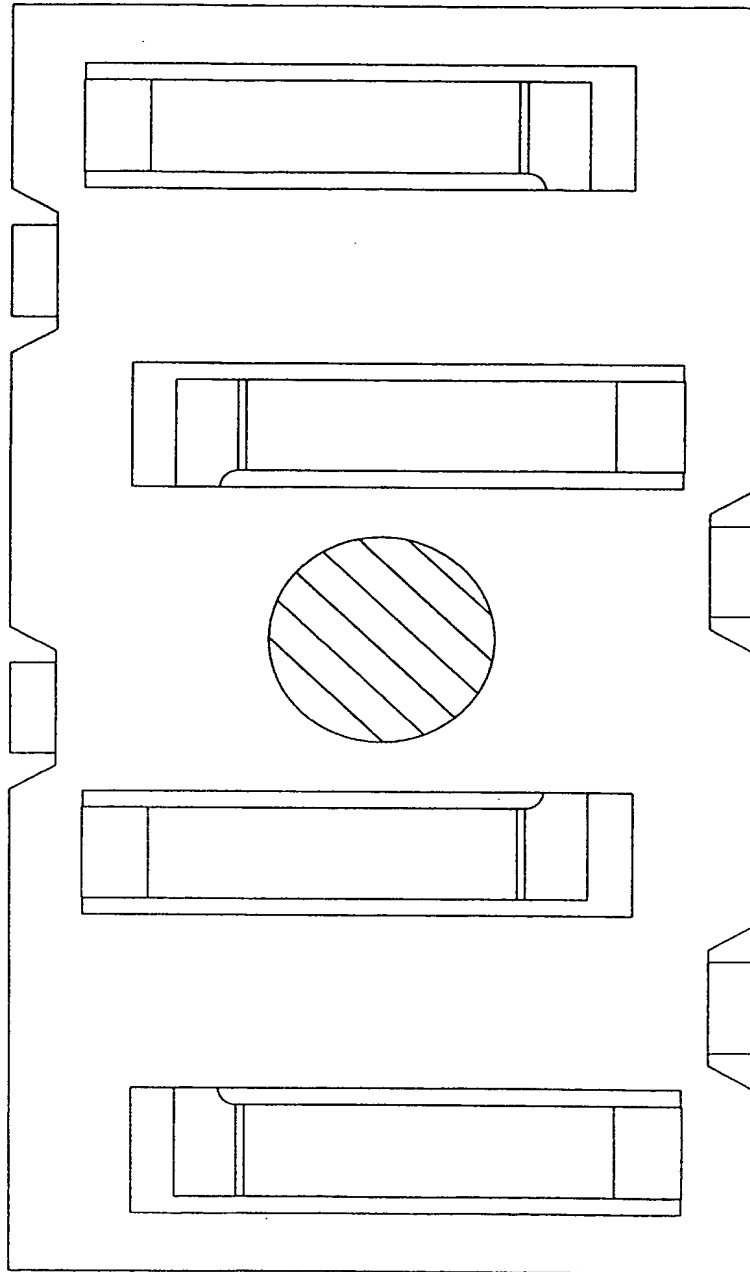
48168  
26-10-98  
115



- 98168  
26-10-98  
2/5



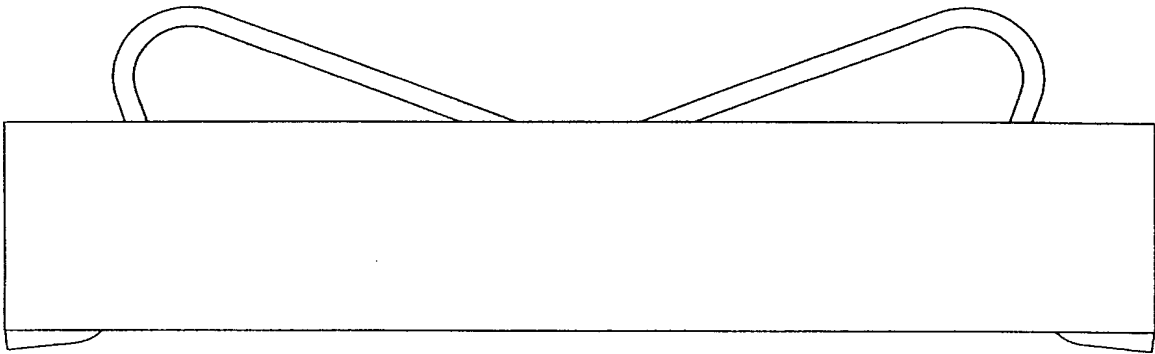
48168  
261098  
3/5



The image displays four technical drawings of a mechanical assembly, labeled 1, 2, 3, and 4, arranged vertically. Each drawing shows a different view of the assembly, which consists of a bracket and a shaft with a pin.

- View 1 (Top):** A side view showing the bracket on the left and the shaft extending to the right. The shaft has a pin inserted through its center. The bracket has a vertical plate and a horizontal plate.
- View 2:** A top-down view of the assembly. The bracket is on the left, and the shaft extends to the right. The pin is visible in the center of the shaft.
- View 3:** A side view of the assembly, similar to View 1 but from the opposite side. The bracket is on the right, and the shaft extends to the left. The pin is visible in the center of the shaft.
- View 4 (Bottom):** A bottom-up view of the assembly. The bracket is on the right, and the shaft extends to the left. The pin is visible in the center of the shaft.

98168  
261098  
5/5



Département Propriété  
Industrielle, Paris  
30, avenue Kléber  
75116 Paris - France  
Tél. : + 33 (0)1 40 67 63 00  
Fax : + 33 (0)1 40 67 64 84

eu/2

Cabinet Christian SCHMIT et Associés  
13, place Notre-Dame  
95300 PONTOISE

Paris, le 25 janvier 1999

A l'attention de Mr SCHMIT

**OBJET :** Préparation d'une demande de brevet

N/REF : F°102140/SHE

Monsieur,

Suite à notre conversation téléphonique de ce jour, veuillez trouver ci-joint :

- copie d'une fiche d'informations techniques;
- copie d'une "Administrative information" et "Technical information" sur la base de laquelle la décision de dépôt a été prise.

Nous vous remercions de bien vouloir préparer une demande de brevet prête au dépôt pour le 1<sup>er</sup> Mars 1999.

La personne à contacter pour obtenir des informations complémentaires est Monsieur Jean-François GRIMALDI (☎ 01-55-66-34-22) d'ALCATEL BUSINESS SYSTEM MOBILE PHONES à Colombes (32, avenue Kléber).

Je vous remercie de bien vouloir faire une copie de vos correspondances avec l'inventeur non seulement à moi-même, mais aussi à Monsieur Xavier de FAY d'Alcatel Business System à Colombes.

En vous remerciant par avance pour votre coopération, je vous prie d'agréer, Monsieur, l'expression de mes sentiments distingués.



Sylvie HERVOUET  
☎ 01-40-67-64-22  
Fax : 01.53.64.56.26

P.J. : Pièces annoncées.



## **TECHNICAL INFORMATION**

**Company Ref.** : FIT 98168 - F°102140

**Originating BD** : PCD

**Affected BD** : PCD

**Title** : CMS battery connector with minimum size

**Product line N°** 2000 **Patent classification** 2041

**Problem** : To enhance the electrical connection between a PCB and a battery with a thickness and surface as small as possible.

**Prior art** :

**Basic idea** :

- look for a very thin connector (result=1.8mm)
- give the priority to the thickness in the connector technical design
- use all the connector width to make the contacts as long as possible

**Solution** : U-shape instead of a straight shape (see figure)

**Advantages** :

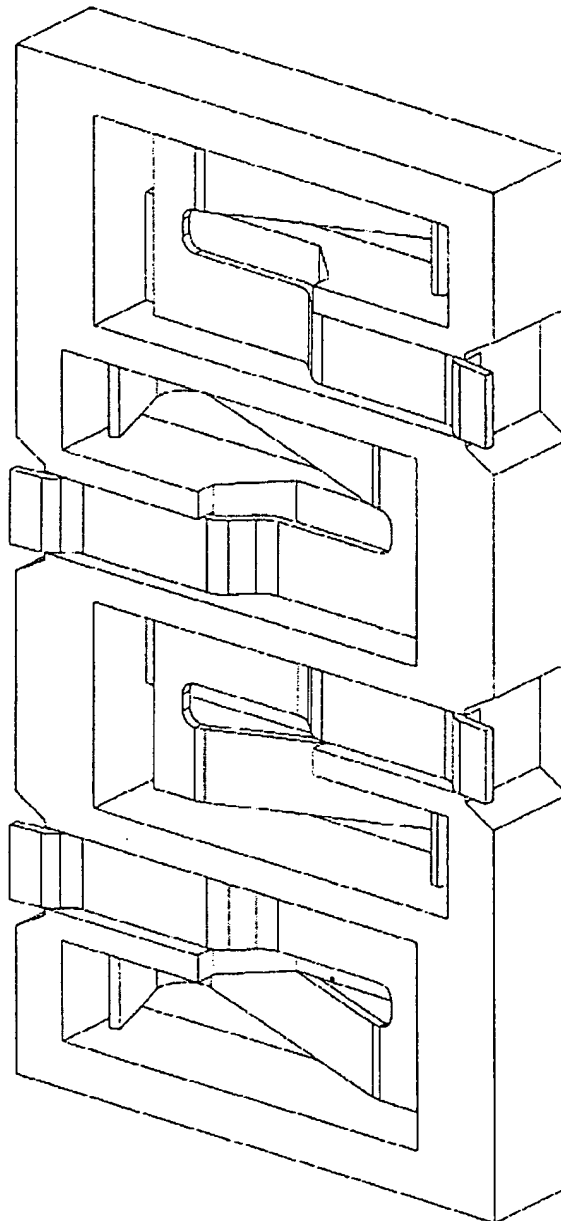
- minimum size (thickness = 1.8mm)
- big stroke available (up to 1.5mm)
- important strength available (150g per contact)
- CMS component : automatic soldering process
- this design can not be duplicated : this idea is based on the only possible (and new) shape for the contacts

**Disadvantages** :. require 2 different shapes of contact

**Draft of claim 1** :

An electrical connector assembly comprising :

- an insulative housing having a top side, a bottom side, a front side and a rear side ;
- a compartment in the housing defined by a first opening in the top side and a second opening in the bottom side ;
- a spring contact element disposed in said compartment and comprising a cantilevered portion extending through said first opening; wherein said cantilevered portion constitutes one arm of a U-shape spring contact element, whose second arm extends inside said compartment and is connected at its end to said housing"



---

**Name of the person having filled in the form : Sylvie HERVOUET**



FO102140/SHE

ALCATEL

FICHE D'INFORMATION TECHNIQUE

N° 98168

ABS - PCD  
Professional & Consumer Division

FIT

Project PMC2	Funding Sources	Research Case	Domain	Product	Keywords
-----------------	-----------------	---------------	--------	---------	----------

**CETTE FIT SERA COMMUNIQUEE A IPD POUR ANALYSE DE BREVETABILITE**  
**Son traitement sera plus rapide si elle est rédigée en langue anglaise.**  
 IL N'Y A PAS DIVULGATION LORSQUE LA COMMUNICATION S'EFFECTUE DANS LE CADRE D'UN ACCORD DE CONFIDENTIALITE; IL N'EST PAS POSSIBLE DE PROCEDER A UN DEPOT DE BREVET APRES DIVULGATION.  
 LA PROCEDURE D'URGENCE SERA EVENTUELLEMENT A DECLENCHER SI LA DECISION A ETE PRISE D'UNE DIVULGATION TELLE QUE CONTRIBUTION ETSI, ET PROPOSITION A UN CLIENT SANS NON DISCLOSURE AGREEMENT.  
 Joindre Justificatif avec la FIT et remettre le dossier en main propre au Responsable Brevets

Date Emission

☒ Mobile☐ Résidentiel

Business Unit

☐ Professional☐ Internet☐ Computer

06-07-01.7.7.7

NOM	PRENOM	SERVICE	SITE	TELEPHONE
GRIMALDI	JEAN-FRANCOIS	MED		0155663422
DAUBA	JEAN-MARC	MED		0155667836

TITRE (Obligatoire - de 10 à 15 mots) - Title (mandatory)

CMS BATTERY CONNECTOR WITH MINIMUM SIZE

1 - PROBLEME TECHNIQUE A RESOUDRE :

What is the technical problem which the author of this FIT had to solve ?

To enhance the electrical connection between a PCB and a battery with a thickness and surface as small as possible.↓  
Printed Circuit Boards

2 - SOLUTION(S) TECHNIQUE(S) ANTERIEURE(S) :

Which is to the knowledge of the author the best already existing (prior art) solution to this problem ?

Several connectors already existing but with an other contact shape (other contact bending and cut out design)

3 - POURQUOI EST-CE INSUFFISANT ? - Why is the best prior art solution not good enough ?

Connectors already available on the market are too big

102140

ALCATEL

ABS - PCD  
Professional & Consumer DivisionFICHE D'INFORMATION TECHNIQUE  
FIT

N° 98168

## 4 - IDEE DE DEPART AYANT CONDUIT A CETTE SOLUTION - Basic idea of the author's solution

- look for a very thin connector (result=1.8mm)
- give the priority to the thickness in the connector technical design
- use all the connector width to make the contacts as long as possible

## 5 - BREVE DESCRIPTION : JOINDRE DESSINS EVENTUELLEMENT

Short description of the solution (add extra sheet and drawing(s) where necessary)

- see drawings attached
- new contact shape : U shape (usual shape = straight)
- assembling of the contacts is done head to foot in order to
  - \* have a symetric configuration for the connector (strengths and weldings)
  - \* leave a free space for the pick and place area
- contacts are assembled into the plastic and not welded ( less expensive process)

## 6 - AVANTAGE(S) PAR RAPPORT A LA MEILLEURE SOLUTION CONNUE

Advantage(s) of the new solution (wherever possible with quantification) as compared with the best prior art solution(s) referred to under §2 above

- minimum size (thickness = 1.8mm)
- big stroke available (up to 1.5mm)
- important strength available (150g per contact)
- CMS component : automatic soldering process
- this design can not be duplicated : this idea is based on the only possible (and new ) shape for the contacts

## 7 - DESAVANTAGE PAR RAPPORT A CETTE SOLUTION CONNUE :

Disadvantages of new solution (if possible quantify)

- require 2 different shapes of contact

## 8 - EXPERIMENTATION DE LA SOLUTION

Has the new solution been proved to be workable by experiment, by simulation, by use (if all answers are negative, when can such prove be expected)?

OUI ☒ NON ☐ QUAND 

Merci de répondre à la question posée.

## 9 - DATE DE 1ERE PUBLICATION OU DATE D'UTILISATION PUBLIQUE DU PRODUIT AVEC LA SOLUTION

Date of envisaged first publication or sale or public use of a product using the new solution

## 10 - EST-IL ENVISAGE DE PRESENTER LA SOLUTION TECHNIQUE A LA STANDARDISATION ?

Is it expected that this technical solution will be presented as proposal to a standardization body? if so : when? to which body?

NON ☐ OUI ☐ QUAND  OU 

Merci de répondre à la question posée.

## 11 - Y-A-T-IL UNE RAISON POUR QUE LA SOLUTION TECHNIQUE PUISSE AVOIR UN INTERET PARTICULIER POUR NOS CONCURRENTS : QUI ? QUELLE RAISON ?

Is there any reason to believe that this technical solution is of particular interest to competitors? if so: which competitor(s) and for what particular reason?

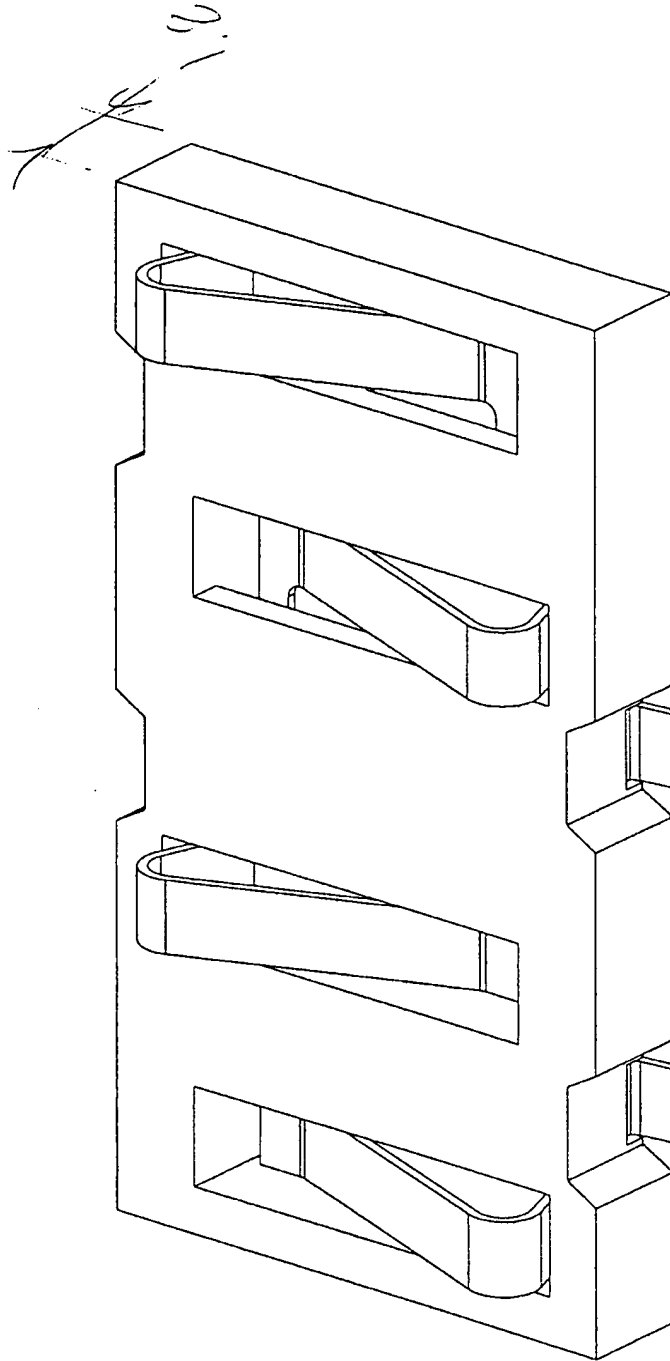
YES. For any firms involved in the mobile phones design.

Reason = this connector participate to the phones size reduction. This concept could be used by one of our competitors.

## 12 - AUTRE INFORMATION UTILE - Other useful information

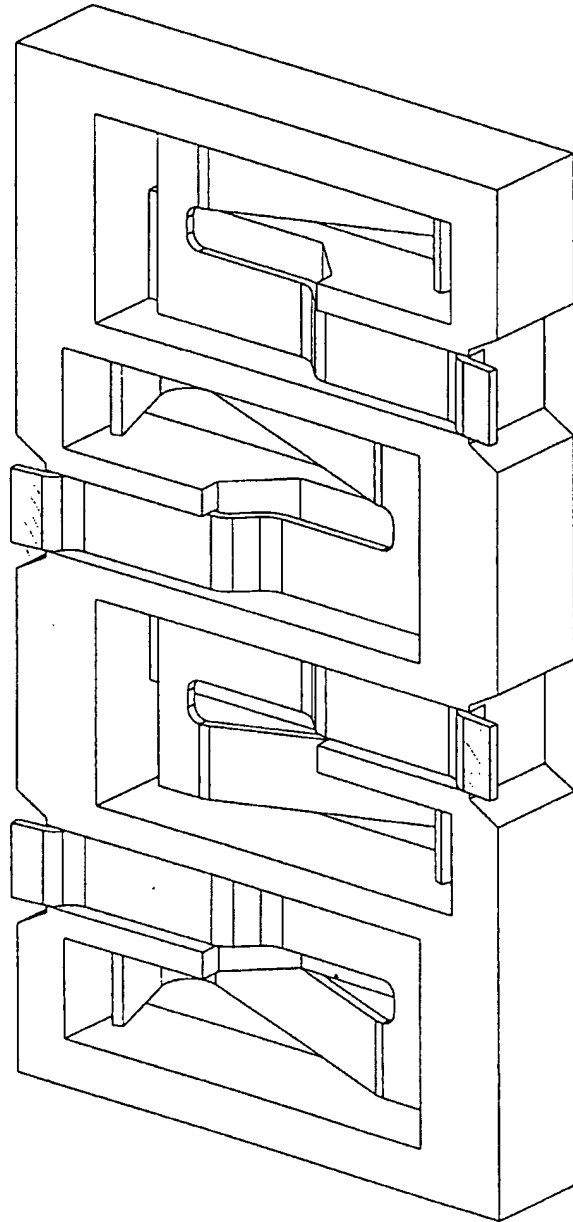
102140

98168  
26-10-98  
1/5



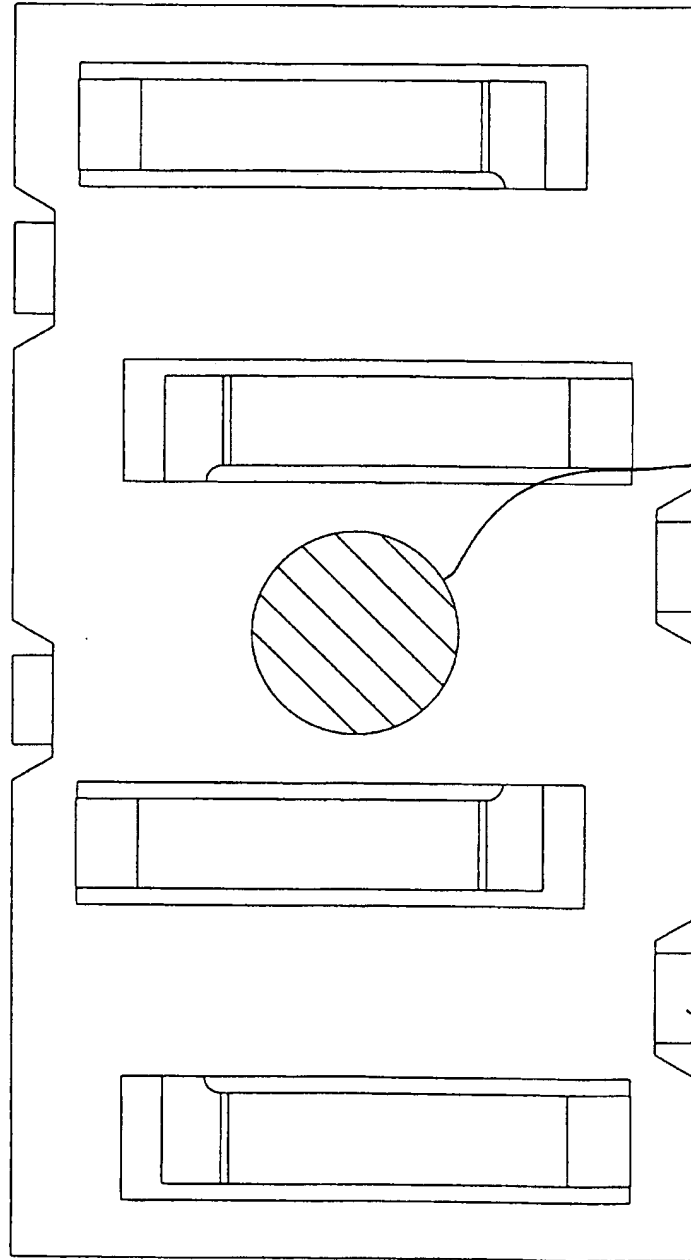
102140

98168  
26-10-98  
2/5



101140

98168  
261098  
3/5

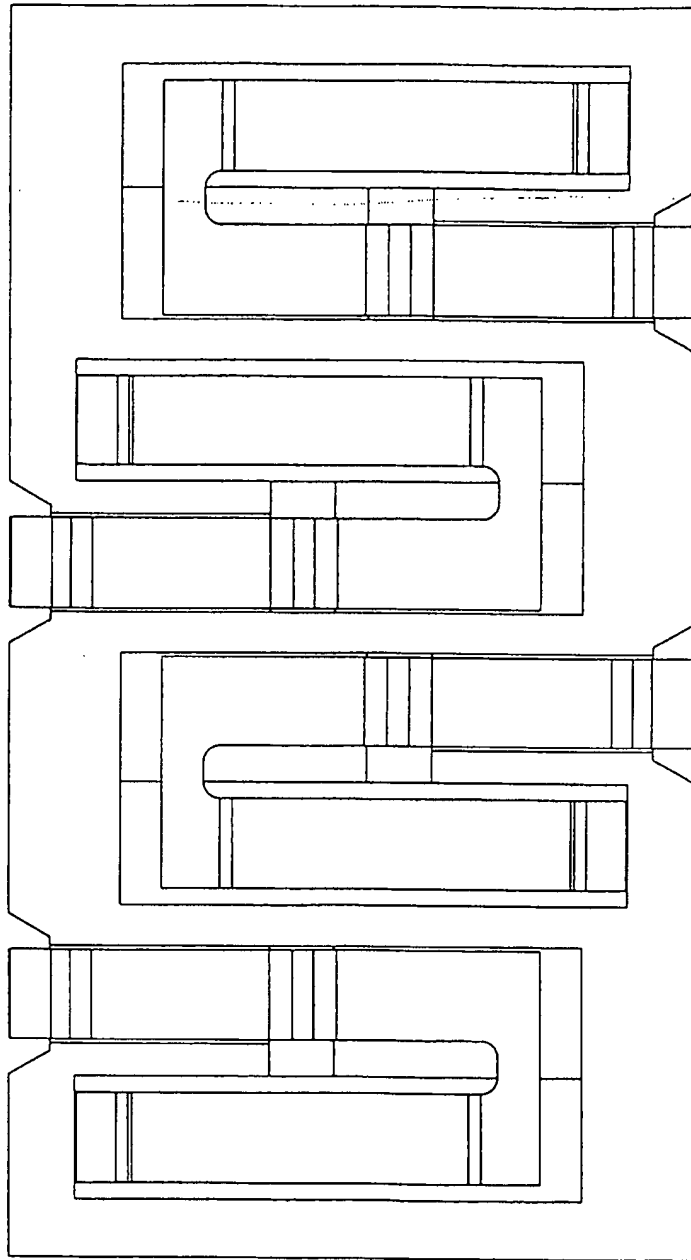


dimension de  
la pipette d'aspiration  
pour mettre en place  
le composant.

Contacts  
soudés au ci

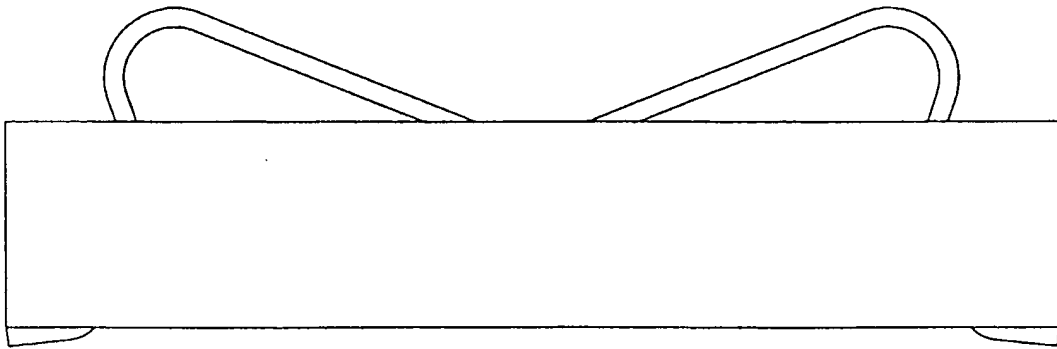
102140

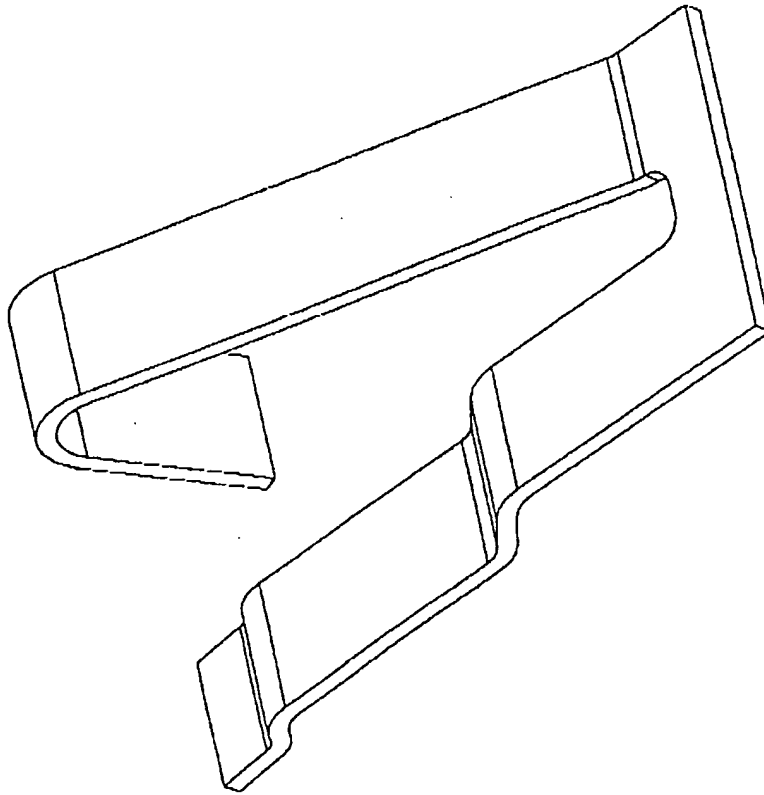
98168  
261098  
4/5



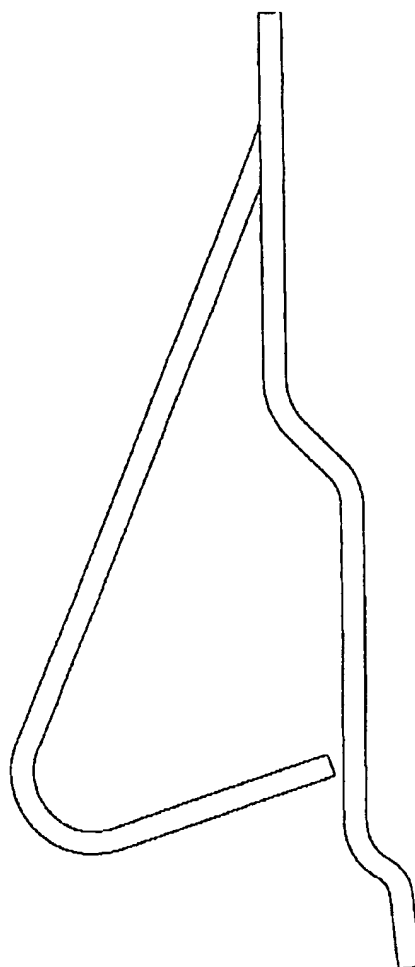
102140

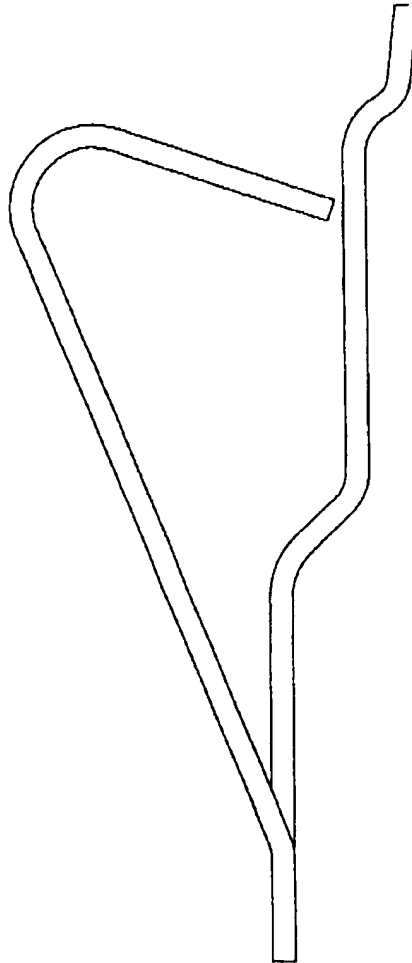
98168  
261098  
5/5











**TRANSLATION OF THE LETTER DATED January 25, 1999**

**Cabinet Christian SCHMIT et Associés  
13, place Notre-Dame  
95300 PONTOISE**

Paris, January 25, 1999

Attention : Mr. SCHMIT

**SUBJECT: Draft of a Patent Application**

O/REF: F°102140/SHE

Dear Sir,

Further to our today's phone conversation, please find attached:

- Copy of Technical Information Form
- Copy of the filing decision forms : "Administrative Information" & "Technical Information"

I thank you to provide us with a Patent Application for filing on March 1<sup>st</sup>, 1999.

If you need further information, please do not hesitate to contact Mr. Jean-François GRIMALDI (Phone: +33 1 55 66 34 22) from ALCATEL BUSINESS SYSTEM MOBILE PHONES at Colombes (32, avenue Kléber).

I thank you to provide, myself and Mr. Xavier de FAY from Alcatel Business System at Colombes, with copy of all your correspondences with the inventor.

We thank you in advance.

Faithfully yours,

A THIN CONNECTOR THAT IS SURFACE MOUNTED ON A PRINTED CIRCUIT

The present invention relates to a thin connector that is surface mounted on a printed circuit. The invention finds applications more particularly in the field of telecommunications, especially in the context of miniaturizing mobile telephones. This type of connector is generally used to interconnect a battery and a printed circuit inside a mobile telephone, in a reversible manner. At present, this type of connector includes spring contacts which are soldered via a surface of a first end to a printed circuit and which have at their second end a flexible tongue which is curved over the first end. The flexible tongue can in particular come into contact with terminals of a battery located above the connector. The invention proposes such a connector that is surface mountable on a printed circuit, and that is small.

The connectors fitted into mobile telephones are generally in the form of rectangular blocks. This type of connector has compartments which contain spring contacts. These compartments open onto a top face and a bottom face of the connector. A spring contact inserted into the compartment is generally U-shaped, lying on either the bottom or the top face of the connector. In this case, a first arm of the U-shape is directed towards the bottom face, and a second arm of the U-shape is directed towards the top face of the connector. The first arm of the U-shape is fixed, for example soldered, to a printed circuit in contact with the bottom face of the connector. The second arm forms a boss projecting from the top face of the connector. The first arm is joined to the second arm by a bend of the U-shape. The bend is in the shape of a circular arc.

The total height of the U-shape is made up of three heights added together. These three heights are defined by the shortest distances between two planes parallel to

the plane of the printed circuit and containing points of the spring contact. A first of these three heights is the distance between the point where the first arm is soldered to the printed circuit and the point where the first arm contacts the bend. A second of these three heights is equal to a diameter of the bend. A third of these three heights is the distance between a point on the second arm which is the highest point relative to the bend and a point of contact between the second arm and the bend. The thickness of the connector is defined by the shortest distance between the bottom face and the top face and, because the spring contact is intended to be partly depressed within the compartment of the connector when it is loaded, is less than the total height of the contact. One example of a connector of the above kind is 3.2 millimeters thick.

The current trend to miniaturization of electronic devices, such as mobile telephones, makes it necessary to reduce the size of the various components of such devices. In particular, connectors included in such devices must be small, for example with a thickness of up to 1.8 millimeters and other dimensions in the usual proportions.

In the prior art, reducing the thickness of the connectors and the total height of the spring contacts that they contain is possible only at the cost of a significant increase in the width or length of the connectors. This is because the structure of existing spring contacts means that their total height can be reduced only by altering the first and third of the aforementioned three heights. To retain the technical characteristics of the contacts, reducing the first and third of these heights entails thickening or widening the contact leaf springs, in particular the leaf spring of the second arm. Widening the contact leaf springs widens the connector overall. Thus the overall volume of the connector cannot be reduced. The structure of existing

spring contacts therefore makes miniaturizing such connectors a problem.

For the purpose of being surface mounted on a printed circuit, this type of connector is picked up by suction pipettes. These pipettes must come into contact only with areas of the connector where there are no spring contacts. The provision of an area of this kind, which is generally in a central position on this type of connector, necessarily implies an increase in the width of the connector. Consequently, this type of connector is currently picked up by two pipettes, one at each end of the connector. This type of connector thus requires two pick-up means. This represents another problem with manipulating prior art connectors.

The object of the invention is to remedy the above-mentioned problems by proposing a connector including a U-shaped spring contact such that a first and second arm of the spring contact are mobile in two distinct, parallel planes that are orthogonal to planes formed by bottom and top faces of the connector. The arms are still interconnected by a bend, but now the bend is developed parallel to the bottom and top faces, and is no longer vertical relative to said faces. The spring contact thus has a total height smaller than the usual spring contact. The connector is thus thinner than current connectors.

Spring contacts are placed in compartments of the connector. In the invention, the compartments of the connector are larger, they include a first entry on a top face and a second entry on a bottom face of the connector. Given the shape of the spring contact, the first entry does not overlie the second entry, at least not completely. The bend joining the first and second arms is inside the compartment. It has a plane of curvature which is substantially parallel to the bottom and top faces. Increasing the width of the spring contact implies a small increase in the width of the

connector. This is because the contacts are disposed so that the first arms of the contacts on the bottom face are aligned with the spaces between the second arms on the top face. This reduces the overall volume of the connector, which has previously been impossible.

The arms of the spring contacts are arranged to produce an area with no spring contacts in the middle of the top face. A suction pipette can be applied to this area. The connector can therefore be picked up by a single pipette.

The invention thus provides a connector that is surface mountable on a printed circuit, the connector being provided with a top face and a bottom face opposite from the top face, the connector including a compartment defined between a first entry of the top face and a second entry of the bottom face, and a U-shaped spring contact, the connector being characterized in that the U-shaped spring contact has a bend having a plane of curvature which is parallel to the top and bottom faces.

The invention will be better understood on reading the following description and examining the accompanying drawing. In the drawing, which is given entirely by way of non-limiting and illustrative example of the invention:

- Figure 1 is a view of a bottom face of the connector of the invention,

- Figure 2 is a view of a preferred example of a U-shaped or flat spring contact of the invention, and

- Figure 3 is a view of the top face of the connector of the.

In Figure 1, the connector of the invention has a body 1 which has a bottom face 2 (shown) opposite from a top face 3 (not shown). The body 1 has compartments 4. A compartment 4 has a first entry 5 opening into the bottom face 2 and a second entry 6 opening into the top face 3. The two entries 5 and 6 are separated by a wall 4.1. The connector includes spring contacts 7, each in a

respective compartment 4. The body 1 has thickness 8. The thickness 8 is preferably not greater than 1.8 mm. The body 1 has width 9 and length 10. Figure 1 shows a preferred example of the invention, in which the body 1 has four compartments 4 containing four spring contacts 7. In this case, the width 9 is preferably equal to 8.3 mm and the length 10 is preferably equal to 15.3 mm. However, the connector of the invention can have any number of compartments each containing a spring contact. The dimensions can be adapted to suit the required number of spring contacts or the required technical characteristics.

In Figure 2, the spring contact 7 has a first arm 11 and a second arm 12. The first arm 11 and the second arm 12 are joined by a bend 13. The base 13 has a plane of curvature 13.1. The arms 11 and 12 are separated by the bend 13. They are mobile in parallel planes therebetween, perpendicular to the plane of curvature 13.1. Here, the plane of curvature 13.1 is shown parallel to the bottom and top faces, but it can also slope relative to the bottom and top faces. In this case, the expression "plane of curvature" refers to the plane into which the curvature is projected along an axis perpendicular to the bottom and top faces. Nevertheless, the advantage of this solution is not as great as that of the solution presenting a plane of curvature that is actually parallel to the faces.

The first arm 11 is rectangular with a first bayonet-type offset 14 and a second bayonet-type offset 15. The two bayonet-type offset 14 and 15 define three portions of the first arm 11. A first portion 16 consists of the end of the first arm 11. The end 16 is a free end adapted to be soldered to a printed circuit. A second portion 17 between the bayonet-type offset 14 and 15 is a plane portion. The portion 17 is adapted to be retained in the compartment 4 of the body 1. A third portion 18 is defined between the bayonet-type offset 15



and the bend 13. The portion 18 is mobile in a plane orthogonal to the plane formed by the portion 17. The portion 18 is mobile relative to the portion 17 by virtue of a hinge formed by the bayonet-type offset 15. The bayonet-type offset 15 also stiffens the arm 11.

The second arm 12 includes a first shoulder 19 and a second shoulder 20. A first portion 21 of the second arm 12 is defined between the shoulders 19 and 20. The shoulder 19 hinges the portion 21 relative to the plane of curvature 13.1. The first portion 21 is plane and rectangular. In a preferred example, the shoulder 20 and the portion 21 are adapted to come into contact with terminals of a battery held against the arms 12 projecting from the top face 3. The shoulder 20 separates the first portion 21 from a second portion 22 of the second arm 12. The shoulder 20 forms a projecting corner such that the second portion 22 is slightly curved under the first portion 21. The portions 21 and 22 of the second arm 12 are mobile in a plane perpendicular to the plane of curvature 13.1. The arm 12 is also mobile in a plane separate from but parallel to the plane in which the arm 11 moves.

The total height of the spring contact 7 is made up a first height equal to the height of the first arm 11 plus a second height equal to the height of the second arm 12. This is because the height of the bend is virtually zero, since it is equal to the thickness of the leaf spring constituting the spring contact. The two heights are defined in absolute terms by the shortest distance between two planes parallel to the plane 13.1. The first height is equal to the sum of a height 23 corresponding to the height of the end 16, a height 24 corresponding to the height of the bayonet-type offset 14 and a height 25 corresponding to the height of the bayonet-type offset 15. The second height is equal to the height 26 of the first portion 21.

The second portion 22 has a height 27. The height

27 is made as large as possible so that the second arm 12 does not exit completely from the body 1. In a different example, the portion 22 could have lugs at one end for retaining it in the second entry 6.

5           The spring contact 7 is retained in the compartment 4 of the body 1 by fixing means 28 which hold the portion 17 pressed against a rim 29 of the first entry 5. The fixing means 28 are drops of plastics material melted onto the spring contact 7 after said spring contact 7 has  
10           been positioned in the compartment 4. The spring contact 7 is preferably inserted into the body 1 via the first entry 5 on the bottom face 4. The size of the first entry 5 is such that it allows all of the spring contact 7 to pass through it. In contrast, the second entry 6  
15           allows only the second arm 12 of the spring contact 7 to pass through it. The arm 11 is retained in the first entry 5 by the wall 4.1. The compartment 4 therefore includes a hole leading from the first entry 5 to the second entry 6 whose cross-section is restricted to the  
20           size of the aperture of the second entry 6. When an object, for example a battery, is pressed against the top face 3 of the body 1, and therefore against the arm 12 of the spring contacts 7, the arm 12 is depressed, the height 26 is reduced and the portion 22 is depressed into  
25           the compartment 4. In one example, the maximum travel of the arm 12 is 1.5 mm. The object pressed against the top face 3 must exert a force lying in the range 0.5 newtons (N) to 1.5 N to depress the arm 12 into its compartment 4.

30           The connector has an axis of symmetry 30 orthogonal to the bottom and top faces 2 and 3 and passing through the center of each of them. The axis of symmetry 30 is a feature associated with the number of spring contacts 7 including in the body 1, and is present only if the  
35           connector includes an even number of spring contacts 7.

          In this case, the connector includes two distinct types of spring contact 7. A first type of contact is

shown in the central portion of Figure 3. A second type of contact is symmetrical to the first type of contact. It is shown in the top and bottom portions of Figure 3. The top and bottom portions are separated by the central portion where the axis 30 is situated.

When looking at a spring contact 7 (Figure 2), with the bend 13 towards the bottom, a first type of contact is such that the second arm 12 is situated to the right of the first arm 11, and a second type is such that the second arm 12 is situated to the left of the first arm 11. The two types of spring contact 7 are present in the connector of Figure 3. They are symmetrical to each other relative to any plane.

These type of contacts are arranged relative to each other in the body 1 to distribute the shoulders 20 alternately over the top face 3. This homogenizes the distribution of the ends 16 on either side of the bottom face 2. The spring contacts 7 are side by side in the body 1. The space between two successive arms 12 on the top face 3 overlies the location on the bottom face 2 of a arm 11 connected to one of the two arms 12. The position of the ends 16 alternates from one contact 7 to the next. The ends 16 project either from a first side 31 of the bottom face 2 or from a second side 32 of the bottom face 2 opposite the first side 31. Both sides 31 and 32 of the connector are therefore fixed to the printed circuit. Because the connector is therefore fixed more firmly, it is not necessary to provide additional soldered joints to guarantee mechanical location of the connector.

To free up an area 33 on the top face 3 sufficient for a pipette, the spring contacts 7 are disposed in a particular manner. The area 33 is required to be centrally located. In this case, two spring contacts 7 which are placed as close to the center of the connector as possible, are of the same type. They are placed opposite each other. One is turned 180° relative to the

other. They are symmetrical relative to the axis 30 which passes through the center of the area 33. The two spring contacts are disposed so that their arms 11 are adjacent. Thus, on the bottom face 2, the two adjacent arms 11 leave a free area 33 on the top face 3 overlying the two arms 11. The area 33 thus freed enables the connector to be picked up by a single pipette having a diameter of at least 2.5 mm.

The connector further includes cavities 34. The cavities 34 are formed in two lateral faces of the sides 31 and 32 of the connector 1 and in such a way that the ends 16 of the spring contacts 7 inserted into the body 1 project from the sides 31 and 32 via the cavities 34. The ends 16 are therefore directly accessible from the side of the top surface 3 for soldering them. This facilitates soldering the ends 16 to a printed circuit.

## CLAIMS

1. A connector that is surface mountable on a printed circuit, the connector being provided with a bottom face (2) and a top face (3) opposite from the bottom face, the  
5 connector including a compartment (4) defined between a first entry (5) of the bottom face and a second entry (6) of the bottom face, and a U-shaped spring contact (7), the connector being characterized in that the U-shaped spring contact has a bend (13) having a plane of  
10 curvature (13.1) which is parallel to the top and bottom faces.
2. A connector according to claim 1, characterized in that the first entry is separated from the second entry  
15 by a wall (4.1).
3. A connector according to claim 1 or claim 2, characterized in that the U-shaped spring contact is held in the compartment by a first arm (11) fixed to a rim  
20 (29) of the second entry.
4. A connector according to any one of claims 1 to 3, characterized in that the U-shaped spring contact has a second arm (12) projecting from the first entry.  
25
5. A connector according to any one of claims 1 to 4, characterized in that it includes two distinct types of U-shaped spring contact, a first type of contact being symmetrical to a second type of contact, relative to a  
30 plane.
6. A connector according to any one of claims 1 to 5, characterized in that the top face includes a single pick-up area (33) situated between two spring contacts of  
35 the same type disposed at 180° to each another.
7. A connector according to any one of claims 1 to 6,

characterized in that the connector has an axis of symmetry (30) orthogonal to the top and bottom faces and passing through the center thereof.

- 5      8.    A connector according to any one of claims 1 to 7, characterized in that the connector includes lateral faces provided with cavities (34), and an end (16) of a first arm opening into such a cavity so as to be soldered to a printed circuit.

10

9.    A connector according to any one of claims 1 to 8, characterized in that the distance separating the top face from the bottom face is not greater than 1.8 millimeters.